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PAPERS

IN

MECHANICKS.

MECHANICKS.

FORTY GUINEAS were this Seſſion voted to Mr. ROBERT HALL, junior, of Basford, near Nottingham, for his ingenious Invention of a Method to EXPAND A SET OF BARS PARALLEL TO THE AXIS OF A CRANE; by which means the velocity of the Rope in raiſing Weights may be increaſed or diminiſhed in proportion to the load to be raiſed.

SIR,

AS the Society for the Encouragement of Arts, Manufactures, and Commerce, have for ſeveral years been deſirous of ſome improvement on the Crane for Wharfs, I have ſent a model of one, for their inſpection, with ſome drawings to elucidate it; and beg you will do me the honour to lay them before the Society.

I am, SIR,
Your moſt humble ſervant,
ROBERT HALL, junior.

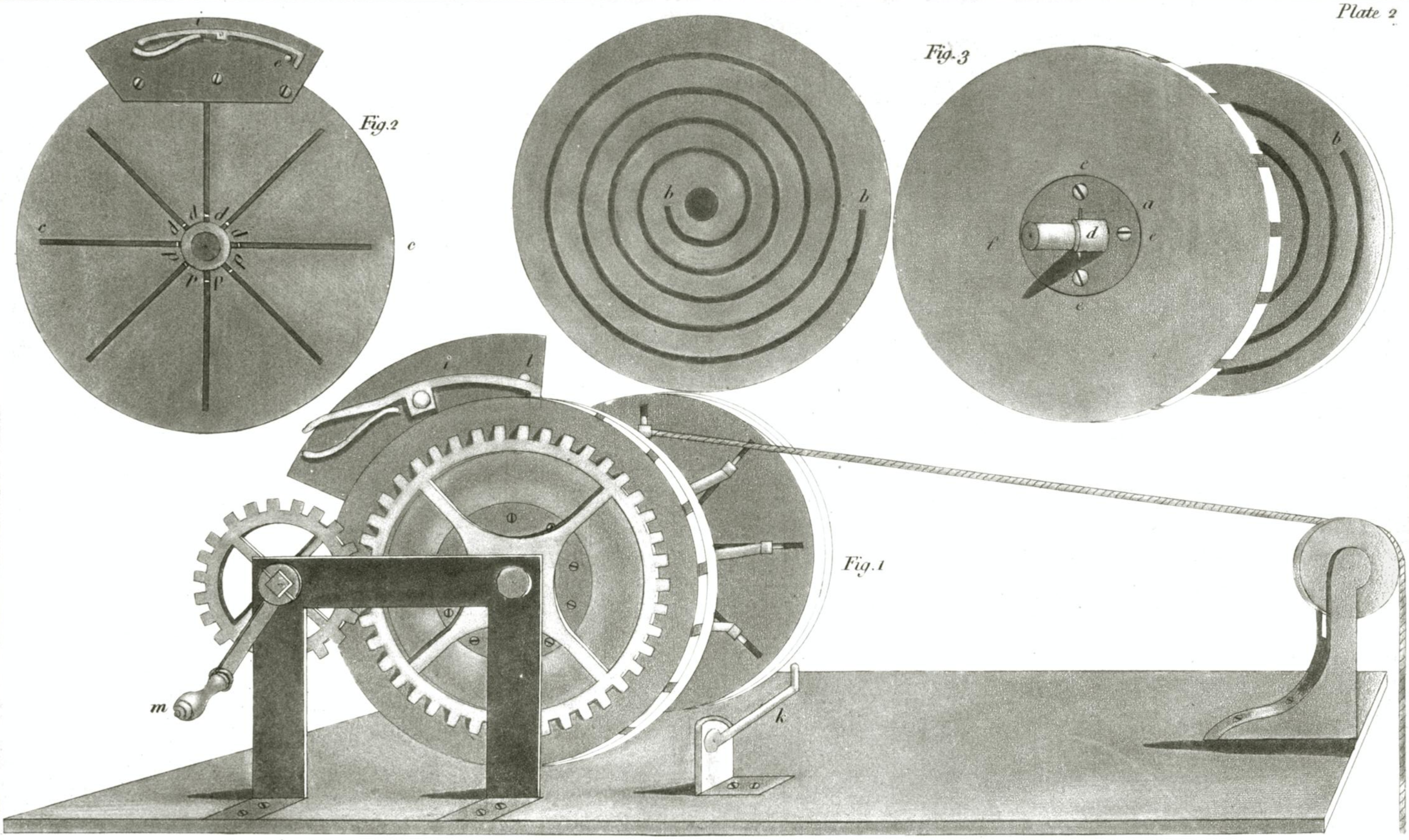
Basford,
Jan. 13, 1794.

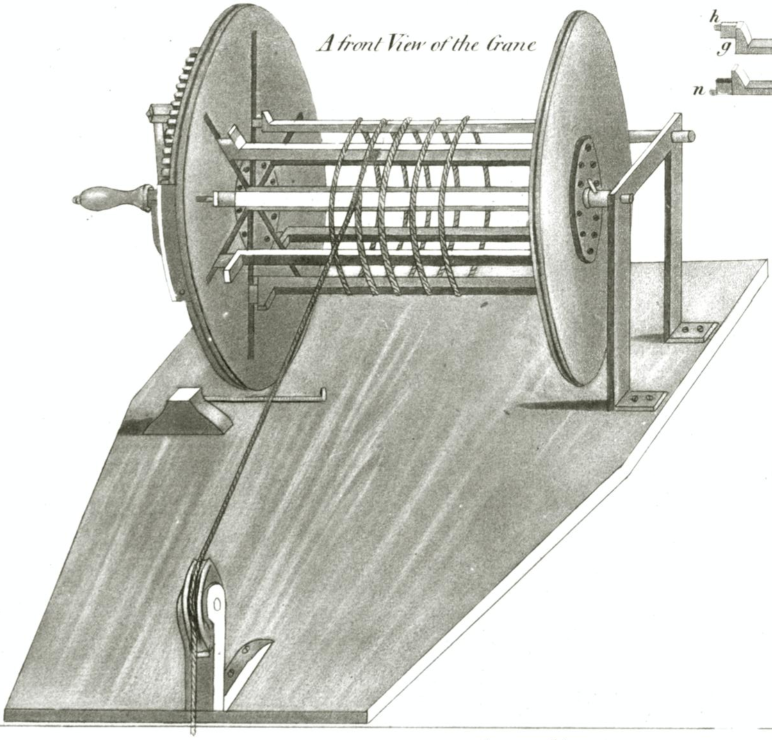
Mr. MORE.

Explanation of the PLATE *of Mr.* HALL's EXPANDING CRANE.

The Reel, fig. 1, is formed of two parts, fig. 2 and 3. The wheels or circles of fig. 3 are held faſt on the ſpindle or axis of the wheel by pins, *a*, and have ſpiral grooves cut in each wheel, as ſeen at *b*. The wheels, fig. 2, have eight long mortiſes, *c*, *c*, cut in each of them, and are connected with an iron tube, *d*, having a flange or collar at each end, with ſcrews, *e*, *e*, to faſten the wheels. When all the parts are put together, as fig. 1, the axis *f*, fig. 3, goes through the tube and wheels, fig. 2, ſo that the two parts are connected. In fixing the croſs bars, one of which is ſeen detached, fig. 4, the parts between the dotted lines, *g*, *g*, ſlide in the mortiſes, fig. 2; and the ſmall ends, or tenons, *h*, *h*, ſlide in the ſpiral grooves, fig. 3. When the two parts are locked by the catch, *i*, fig. 1, which has a ſpring for that purpoſe, the bars are faſt; but, when the relative ſituations of fig. 2 and 3 are altered, by the hook *k* being paſſed through the hole

Plate 2




A front View of the Crane

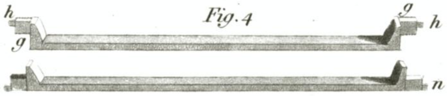


Fig. 4

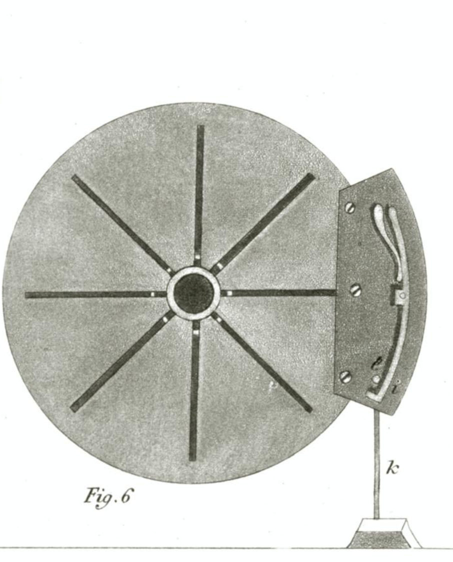


Fig. 6

Mr. Hall's Expanding Crane.

hole *l*, as ſhewn in fig. 6, the bars will all of them remove nearer or further from the centre, by means of the ſpiral groove, fig. 3, letter *b*, ſo that the reel may be enlarged or diminiſhed at pleaſure.

To ſet the hands of the workman at liberty, there is a hook, *k*, which, when the reel is to be altered in its dimenſions, muſt be put into the hole *l*, ſo that it ſhall ſupport the catch up, and hold the part fig. 2 faſt at the ſame time. The handle, *m*, is then to be turned till the reel is of the ſize required; when this is done, puſh out the hook *k*, and the crane is ready for work.

It is neceſſary to obſerve that the tenons, *h*, *h*, muſt be cut, ſo that the outſide of all the bars next the rope ſhall be at an equal diſtance from the centre. If the tenon of the firſt bar that is placed in the reel be cut like the tenons, *h*, *h*, fig. 4, the laſt of them muſt be cut the ſame as the tenons, *n*, *n*, fig. 4; and all the other tenons, at the extremities of the ſeveral bars, muſt be at proper diſtances between theſe extremes, as is ſhewn by the white dots P in the mortiſes fig. 2.

The SILVER MEDAL was this Seſſion voted to GEORGE BUTLER, Eſq. for his Invention of a BUCKET, for drawing Water out of deep Wells, of which a Plate and Deſcription are annexed; and the Model preſented by Mr. Butler is reſerved in the Society's Repoſitory, for the uſe of the Public.

SIR,

YOU may poſſibly recollect my well at Downe in Kent, which is about three hundred and ſixty feet deep; and is worked by two buckets and a horſe-wheel, each bucket holding little leſs than a barrel; and are the ſame ſort of buckets, with the ſame mode of emptying, as at Dorking, Dover, Haſted, and all the deep wells I have met with.

The great weight of iron on thoſe buckets to make them ſink immediately on deſcending to the water, being obſerved, together

with

with the heavy flat iron chain by which they are hung to the rope; and which, paſſing over a flat-grooved wheel above, brings the face of the buckets properly to the ciſtern catch, ſuggeſted the following idea.

A valve, of five inches diameter, was put into the lower head of a common light beer-barrel; a croſs was placed in the centre of the top of the barrel; it was then let down into the well by a rope; it filled through the valve in the bottom, and came up very ſteady and full, with ſcarce any drip: what little drip there was fell immediately down the well from the valve in the centre of the bottom, without wetting the deſcending rope, ſuch wetting being very prejudicial to the rope, as in uſe with the old buckets; for by the nature of their bails they aſcend ſwinging, ſometimes ſtrike in paſſing, and by ſplaſhing over the ſides are never full.

Two buckets on the new conſtruction were immediately made with iron hoops, as light as poſſible; they have worked four years without being out of condition; the hoops, chains, &c. of theſe buckets weigh leſs than the old ones by two hundred weight. The well rope is little more than half the ſize and coſt; a much greater quantity of water is raiſed in an equal time, and the labour of the horſe much relieved.

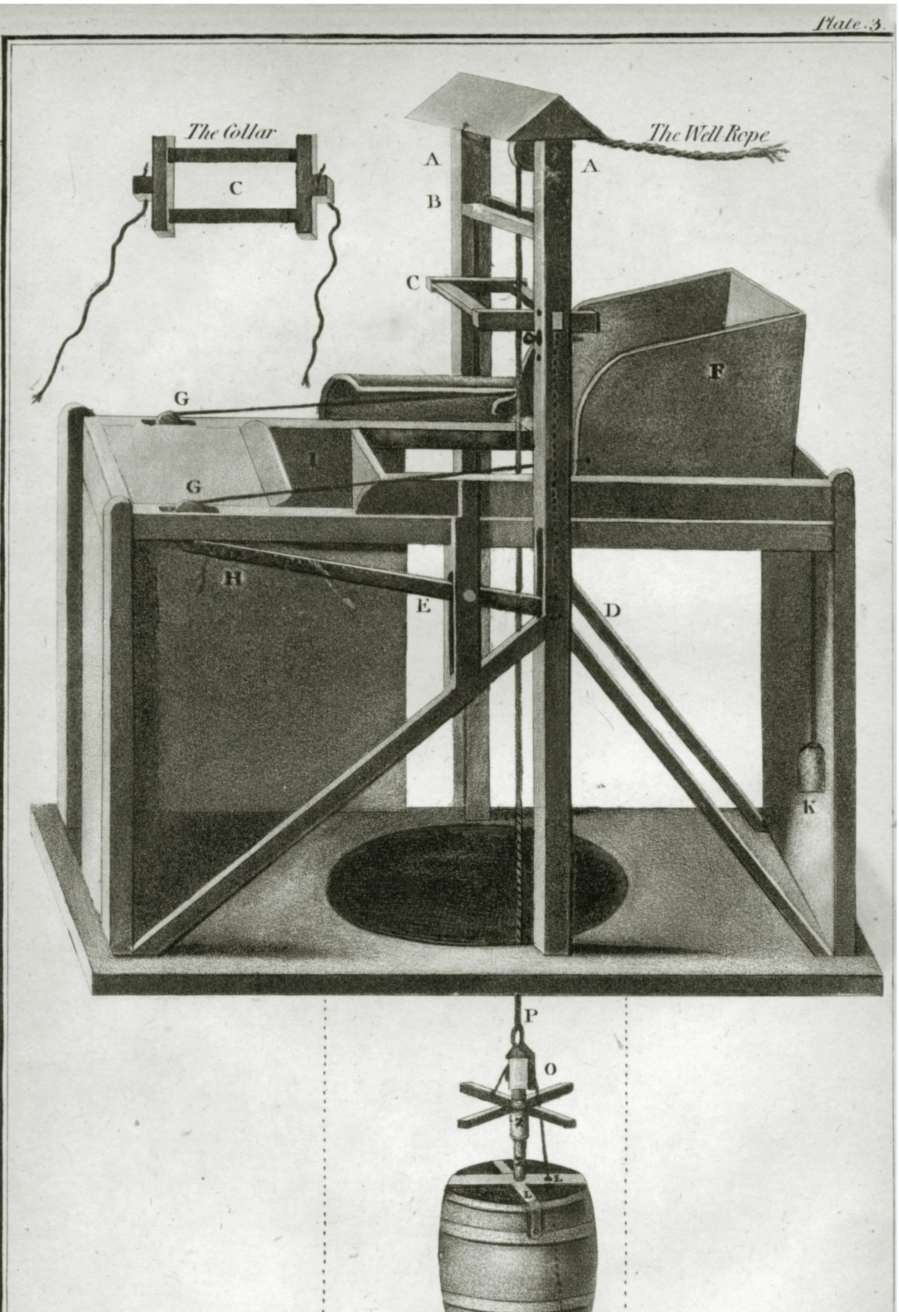
Herewith I have ſent you a working model of the machine, ſhewing the action of the valve buckets, which I requeſt you to preſent to the Society for the Encouragement of Arts, Manufactures, and Commerce. I have not the leaſt doubt that many gentlemen of the Society may improve upon the hint; and I ſhall be much pleaſed to be the means of giving any aſſiſtance to thoſe countries who labour under the lamentable inconvenience of deep wells and little water.

I am, SIR,

Your moſt obedient ſervant,

GEORGE BUTLER.

Great Ruſſel-ſtreet,
Nov. 22, 1793.



Mr. Butlers improved Water Bucket.

Explanation of the PLATE *of the Model of Mr.* BUTLER'*s* MACHINE FOR RAISING WATER, AND IMPROVED WATER-BUCKET.

A A. Two poſts fixed in the curb of the well, oppoſite each other, and grooved within to receive the ends of the collar.

B. Two parallel bars, which bear down the ſmall iron arms or croſs as the bucket aſcends, and open the valve to diſcharge the water.

C C. The collar reſting on pegs in the groove; and, being lifted by the bucket in aſcending, communicates by a rod or line down the groove, with the ſhort end of the moveable bars at D: the ſhort end of theſe bars, which work on an axle at E, being ſo moved, draws forward the trough, F, with an increaſed velocity, by means of the lines paſſing from it over the pullies G, G, and faſtened to the long end of the bar at H, by this action the trough runs under the bucket, and is ready to deliver the water into the ciſtern, I; when the valve Q, (which is about five inches diameter) is opened by the croſs, L, ſtriking the bars at B.

F. The trough, moving on four braſs rollers; which, on the water being delivered, runs back, as the bucket deſcends, with the ſame velocity as it was drawn forward: this is done by means of the weight, K, hid within the lining of the model, and connected by a line, paſſing over a pulley in the frame above, to the centre of the hinder part of the trough.

L. Two thin pieces of iron fixed acroſs the top of the bucket: in the centre of theſe pieces is placed the ſmall iron ſtandard, M, on which is a collar with four arms, N, made to move up and down; above the collar is a ſmall braſs pulley in the mortiſe, O, in the upper part of the ſtandard, and a loop to which the well-rope, P, is made faſt: to one of the arms of the collar is tied a cord, which paſſes over the braſs pulley above, and then down to the lip of the valve; ſo that the croſs, L, being preſſed againſt the bars, B, is forced downwards, the cord drawn up, and the valve opened.

The following Attempt to obtain and preſerve PRACTICAL STANDARDS, for adjuſting, in future, the Weights and Meaſures of this kingdom, is reſpectfully preſented to the Society by their SECRETARY.

MANY learned and ingenious perſons have employed themſelves in attempting to diſcover an univerſal Standard of Weights and Meaſures, renewable (in caſe of its being loſt) in any climate, and under any circumſtances; and ſome papers on this ſubject have been ſubmittted to the public, within theſe few years, by Mr. Hatton (ſee Vol. I. page 239) and Mr. Whitehurſt; but, after paying every attention to this matter in my power, I am induced, with due deference to ſuch authorities, to conclude, that ſuch a ſtandard may rather be conſidered as a thing deſirable, than likely to be obtained, at leaſt ſo as to ſerve practically the uſes in common life. I ſhall therefore beg leave to ſubmit my thoughts on this head, conſidering that what may be hereafter ſaid, is intended ſolely as an eaſy method of forming and preſerving a Standard of Weights and Meaſures for the uſe of theſe kingdoms, or any other that may think proper to adopt it; and which, it is preſumed, will anſwer all that is wiſhed for in obtaining a Practical Standard for adjuſting in future the weights and meaſures of this country.

For this purpoſe I adviſe, that a certain weight be aſſumed, and called a pound; and, to avoid, as much as poſſible, any innovation or confuſion, let this aſſumed weight be adjuſted by the preſent ſtandard pound weight at his Majeſty's Exchequer, or the Guildhall of London. This weight may be made of braſs; but, as all metals are ſubject to decay and loſs by corroſion, by the air, friction, &c. let a piece of agate, or other hard ſtone, be cut into the form of an egg; and when brought exactly to the weight of the braſs ſtandard by carefully grinding and poliſhing, let it be preſerved in a proper caſe lined with ſoft cloth or velvet, to be reſorted to whenever there may be occaſion. A piece of agate of this form ſeems ſo unlikely to be injured by any means, except ſuch a degree of violence as may break it, that there can be little doubt of its remaining of the ſame weight for ages; more eſpecially as it will be effectually guarded from the action of the air, and all motion in its caſe, and never expoſed, but on occaſion of comparing the braſs ſtandard with it; which, to prevent error, ſhould be done at ſtated times, as once in twelve months, on a day ſpecifically appointed for the purpoſe, in the preſence of ſuch officers as may be nominated, and with as much form and preciſion as is uſed in the trial of the Pix to determine the ſtandard of the Coin.

I have hitherto only mentioned the pound weight; but it is obvious that all the parts of the pound, as the half, the quarter, the ounce, &c. ſhould be provided for in the ſame manner. Let it be underſtood that the pound hitherto ſpoken of is ſuppoſed to be what is generally called the Avoirdupois pound, and divided into ſixteen ounces, each ounce ſubdivided into ſixteen drachms. As this is the weight by which all large commodities are weighed, it does not appear to have been thought neceſſary that weights ſmaller than the half-drachm, or the thirty-ſecond part of the ounce, ſhould be introduced; but, as that weight is nearly equal to thirteen grains and one half Troy, it may be further divided, if judged proper, ſo as to weigh ſmall matters, as very fine thread, or other ſuch like valuable commodities, more accurately than is generally practiſed; and, if the drachm is ſubdivided into eight parts, each of them will be equal nearly to three grains and a half Troy. To avoid confuſion, all weights for this purpoſe, when ſold, ſhould differ in form from the grains uſed as Troy weight, and be called by ſome other name.

As it has been always cuſtomary to have weights of different denominations uſed in theſe kingdoms, and no ſufficient reaſon has appeared to juſtify an alteration in the practice; and as the Avoirdupois weight has been conſtantly uſed for large quantities of goods, and the Troy weight for ſmaller quantities and the more valuable commodities; let a Troy pound be prepared as has been already adviſed for the Avoirdupois, with its equal in agate, to be reſerved and uſed in all caſes as the other; and let this pound be divided, as has been the uſage, for the goldſmith, into ounces, penny-weights, and grains; and, for the apothecary, into ounces, drachms, ſcruples, and grains; each of them being adjuſted in the moſt accurate manner poſſible, ſo that all the aliquot parts ſhall bear a due proportion to the whole: and to this the moſt ſcrupulous exactneſs is neceſſary; for, from a defect in this inſtance, moſt of the complaints on the want of a due ſtandard ſeem to have originated.

Having thus, in as conciſe a manner as poſſible, ſubmitted my opinion on an eaſy way of obtaining a practical ſtandard for weights, which may at all times be reſorted to without danger of ſuffering any diminution in bulk or weight; I ſhall only further obſerve that it may be adviſable to have three ſets of theſe agate ſtandards, to be kept at different places; whereby the danger of the loſs of ſuch ſtandard, by fire or otherwiſe, will be effectually guarded againſt.

I ſhall now proceed to ſuggeſt a method, whereby meaſures of length, and conſequently meaſures of capacity, may be formed from the afore-mentioned ſtandards of weight.

It has been univerſally allowed that the weight of a cubic foot of clear ſoft river-water is equal to ſixty-two pounds and a half Avoirdupois weight, or one thouſand ounces; and the moſt celebrated authors have thence calculated and publiſhed the hydroſtatic weight of many ſolids: this appears a ſingular circumſtance, and not likely to have happened by chance, but to have been accompliſhed by means that have not been tranſmitted to us. As this, however, if not ſtrictly true, is not far from the truth, I propoſe forming a meaſure on its principle, to be called the Britiſh foot.

Let, therefore, a hollow cube be made of braſs, of ſuch dimenſion as to exactly contain a quantity of ſoft river-water, equal in weight to ſixty-two pounds and a half, or one thouſand ounces of the above-deſcribed Avoirdupois weight. To arrive at as great a degree of preciſion as poſſible, it may be proper to fix ſome ſtandard of heat, at which, it is intended, the above quantity of water may be reckoned to fill the cube, and this may be at ſixty degrees of Farenheit's thermometer.

It will probably be attended with conſiderable difficulty and expence to procure ſuch a veſſel; but as it is to be preſumed that workmen may be found to execute it, the expence ſhould be no object; for ſuch weights as are above deſcribed, agreeing with ſuch a veſſel of water, will give a preciſion to hydroſtatic experiments, and determine the relative weight of ſolids to water, more clearly than is now eaſily done, and, at the ſame time, form a decided ſtandard of meaſure.

Having therefore procured ſuch a cubic veſſel, the length of one ſide of it is to conſtitute the Britiſh foot, which is to be divided into twelve inches, and thoſe inches into ſmaller parts, as uſual. It is hardly neceſſary to ſay that ſuch a meaſure of length being obtained, it will be proper that ſtandards be made in the manner formerly executed by Mr. Bird; or, if any better have been diſcovered, that ſuch be adopted.

From the ſtandard Britiſh foot are to be calculated all meaſures of length, as yards, furlongs, miles, &c. It will, therefore, be highly proper to have ſome of theſe ſtandards moſt carefully executed, and preſerved, as has been already mentioned concerning the ſtandard weights; and that thoſe in uſe be alſo from time to time examined, and compared with ſome one kept for that purpoſe: ſo that, ſhould any error ariſe, it may not long ſubſiſt, and conſequently not become of magnitude ſufficient to do any injury.

From this meaſure of length, it is eaſy to aſcertain all meaſures of capacity; and if the ſeveral old Acts of Parliament which are ſtill in force be carefully attended to, and the perſons employed to authenticate the meaſures by ſtamps, are fully informed of the neceſſity of the ſeveral meaſures being of the forms and dimenſions preſcribed by thoſe laws, it is preſumed a general meaſure and weight, ſufficiently accurate for all practical purpoſes, may be eaſily made and introduced throughout the kingdom; and of what advantage this would be, need not be mentioned.

At the beginning of this paper, it was obſerved, that I intended merely to confine myſelf to a practical method of obtaining a weight which might ſerve as a ſtandard for this kingdom. All theory, and all mathematical calculations, have therefore been ſeduloully ſeduloufly avoided; and I have through the whole endeavoured to form the new ſtandard on the baſis of the old one, thereby avoiding as much as much as poſſible all innovation; and, although it has been frequently propoſed to divide all weights and meaſures decimally, which certainly in ſome caſes would have its advantages, yet, when it is conſidered how much the generality of the people would be perplexed and confounded, ſhould ſuch a change be adopted, and reflecting how well the trade and commerce of the kingdom may be carried on by conforming to the ancient mode, I have adviſed the adjuſting the weights and meaſures of this country by the means above mentioned, which, as appears to me, may be eaſily put in practice with ſufficient accuracy for all the common purpoſes of life.